Turbine Shaft Shoulder Piloted Shim

Overview
Pratt & Whitney sought a repair design enhancement for a low pressure compressor coupling rotor shaft to address a wear distress caused by heavy axial loading on their aircraft engines. The current repair, a plasma carbide spray, limits the life of the shaft to 11,000-13,000 cycles. The repair design enhancement was to allow the shaft to reach its projected 20,000 cycle life.

Objectives
Develop a shim with recommendations regarding geometry, material, fit and clearances. Provide a manufacturing and assembly plan with the recommended concept.

Approach
- The team generated 5 shim concepts, each with differing geometries
- Created solid models of each concept
- Developed a list of customer needs from Pratt & Whitney
- Used a concept scoring matrix to select a concept
- Performed a finite element analysis on the concept
- Visited a Pratt & Whitney repair facility
- Developed a manufacturing and assembly plan with Pratt & Whitney’s assistance
- Did analysis on potential cost savings
- Developed a report outlining the work performed and delivered to Pratt & Whitney

Outcomes
The repair design enhancement that we developed will allow the low pressure compressor coupling shaft to reach its full life expectancy of 20,000 cycles:
- Pratt & Whitney will recover $80,000 on each shaft ($200,000) by increasing the shaft life 67%
- The shim concept can be used in other Pratt & Whitney aircraft engines experiencing the same problem to recover additional losses
- Cost to manufacture the shim and assemble with shaft projected to be $600
- Final shim design is a great improvement over the current carbide plasma spray repair